CLAIMS

WE CLAIM AS OUR INVENTION:

1. A method for determining a location of a digital radio transmitter comprising:

detecting, by at least three spatially separated receivers, a digitally encoded radio signal having a known pattern of bit transitions radiated from the transmitter;

determining, at each of the receivers, a time of arrival of at least some of the bit transitions;

transmitting, from each of the receivers, an indication of the time of arrival at each respective receiver for each of the at least some bit transitions to a central processor; and

determining, at the central processor, time of arrival differences of common bit transitions among the receivers; and

calculating, at the central processor, the location of the transmitter based on the time of arrival differences.

2. The method of claim 1, further comprising averaging respective times of arrivals for multiple bit transitions in the digitally encoded radio signal to generate an average time of arrival for the digitally encoded radio signal.

3. A method for determining a location of a digital radio transmitter comprising:

detecting a digitally encoded radio signal radiated from the transmitter by at least three spatially separated receivers;

receiving, at each of the receivers, a common synchronizing signal;

detecting, at each of the receivers, bit transitions in the radio signal;

recognizing a desired pattern of bit transitions;

determining, at each of the receivers, a respective time of acquisition, offset from the synchronizing signal, for at least some of the bit transitions comprising the desired pattern;

transmitting, from each of the receivers, an indication of the times of acquisition to a central processor;

determining, at the central processor, time of arrival differences among receivers from differences in the respective indications for common bit transitions in a desired pattern; and

calculating, at the central processor, the location of the transmitter from the time of arrival differences.

4. A method for determining a location of a digital radio transmitter comprising:

detecting a digitally encoded radio signal radiated from the transmitter by at least three spatially separated receivers;

receiving, at each of the receivers, a common synchronizing pulse;

parsing, at each of the receivers, a received radio signal into data block samples;

time stamping, at each of the receivers, each data block sample with a time stamp offset from the common synchronizing pulse;

detecting, at each of the receivers, potential bit transitions in the data block samples;

generating, at each of the receivers, bit transitions from the potential bit transitions;

recognizing, at each of the receivers, a desired pattern of bit transitions;

determining, at each of the receivers, a respective time of acquisition for at least some of the bit transitions comprising the desired pattern;

transmitting, from each of the receivers, an indication of the times of acquisition to a central processor;

determining, at a central processor, time of arrival differences among receivers from differences in the respective times of acquisition for common bit transitions in a desired pattern received from each of the receivers; and

calculating, at the central processor, the location of the transmitter from the time of arrival differences.

5. The method of claim 4, further comprising, for each receiver:

convolving potential bit transitions in the received data block with at least two desired bit transitions to generate a correlation waveform corresponding to each of the desired bit transitions; and

generating a bit transition corresponding to the correlation waveform having a highest peak magnitude.

6. The method of claim 4, further comprising, for each receiver:

associating a first set of times of acquisition with bit transitions comprising the binary forms "01" and "10;"

comparing bit sequences among respective data strings in a repetitively transmitted data string forming at least a portion of the desired pattern to determine if a bit error exists in the data string;

associating a second set of times of acquisition with bits in the data string having "good" calculated time stamps;

determining an intersection of the first set and the second set of times of acquisition;

generating a bit mask corresponding to the intersection;

generating an absolute time of acquisition for at least one bit transition in the signal using an offset value from the common synchronizing pulse;

generating offset times of acquisition for a remainder of bit transitions in the signal using offset values from the absolute time of acquisition; and

generating an indication of times of acquisition comprising the bit mask, the absolute time of acquisition, and the offset times of acquisition.

7. The method of claim 6 further comprising:

performing a logical "AND" among the bit masks; and

determining time of arrival differences for common bit transitions indicated by a result of the logical "AND" of the bit masks.